

Name: _____

Score: _____/118

2016 Forensics Practice Test

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MURDER AT BIKINI BOTTOM!

THE CRIME

Sandy Cheeks, resident of Bikini Bottom, went to bed early to get a good night's sleep for tomorrow's karate competition. Unfortunately, she was not able to attend her competition, which she prepared very diligently for. Someone broke the glass of her dome-home, causing water to rush in. They also stole her glass fishbowl-helmet, so she did not have a way to avoid the water that painfully filled her lungs. The next morning, everyone in Bikini Bottom awoke to sirens, because an ambulance had come to Sandy's dome; however, it was too late...

Sandy Cheeks was dead.

The forensics scientists at the scene are very inexperienced, so they need your help to determine who killed Sandy Cheeks.

As a totally irrelevant side note: Catfish have cat hair, seahorses have horse hair, and dogfish have dog hair.

THE SUSPECTS

Fingerprint and DNA samples were collected from all suspects.

Any additional information collected by our forensic scientists is listed below:

1. Spongebob Squarepants:

- a. Spongebob Squarepants and Sandy Cheeks had been best friends for years; however, they were also rivals in karate, and both of them had registered for the karate competition. Spongebob told us that he had spent the day taking a relaxing bath with some epsom salts, practicing karate with Sandy in her dome, playing with Mystery the seahorse, and looking at his dust collection. We asked him about

some broken glass we found in his house, and he told us that his magnifying glass broke while he was looking at his dust collection.

2. Patrick Star:

- a. Patrick is a close friend of Sandy's, but he's still salty about the fact that she didn't appreciate one of his inventions (the automatic back-scratcher, hair-comber, nose-picker, ukulele-tuner 9000). Patrick spent his day playing with a stray catfish, drawing pictures on a rock with chalk, and eating a donut. We found some broken glass in his house that he says came from a glass of kelp juice he clumsily dropped.

3. Squidward Tentacles:

- a. Squidward doesn't know Sandy too well and he hasn't forgiven her for fusing him to Spongebob due to a malfunction with one of her inventions. Squidward spent his day fertilizing his kelp garden, making flour tortillas, playing his clarinet, and judging dogfish at a dogfish pageant. We found some broken glass in his house but he would not give us an explanation. When we asked around, neighbors told us that they had heard some terrible noise coming from Squidward's house. We concluded that Squidward was playing his clarinet so badly that his windows shattered.

4. Gary the Snail:

- a. Gary is Spongebob's pet, and though he does not know Sandy too well, he angrily told us about this one time when "meow meow meow meow meow meow meow meow meow meow" (our expert translators, using their Snail-to-English dictionary, translated this as follows: Sandy once smashed my shell while she was practicing karate). Gary spent his day at an intense snail racing competition where he flirted with a catfish and knocked over the prize glass vase. The glass cut him, but he made sure to treat it with an antiseptic. Later, he decided to trudge through Squidward's freshly fertilized kelp garden.

THE EVIDENCE AT THE CRIME SCENE

Powders: Powder A, Powder B, Powder C

Glass: A piece of broken glass from Sandy's dome

Hairs: Some hairs were found on the nightstand where Sandy left her fishbowl-helmet

Fingerprints: Fingerprints were found on a piece of broken glass from Sandy's dome

DNA: A DNA sample found on the glass was run through a gel electrophoresis test

Qualitative Analysis (28 pts)

Identify the following powders that were found on the suspects. Write out their chemical formulae and full names. If the chemical is a polymer, write “polymer” in the formula box. Name the person(s) the chemicals were found on.

	Chemical Formula	Name of chemical	Suspect(s) found on
1			
2			
3			
4			
5			
6			

Identify the following powders that were found at the crime scene. Write out their chemical formulae and full names. If the chemical is a polymer, write “polymer” in the formula box.

	Chemical Formula	Name of the chemical
1		
2		
3		

Name the suspect(s) implicated by the evidence:

Qualitative Analysis Comprehension Questions: (21 pts)

1. Identify the colors of the flames for the burn tests of the following compounds. Then identify the atom in the compound that gives the flame its color:

a.

Chemical	Flame color	Atom in question
KCl		
LiCl		
H ₃ BO ₃		
NaC ₂ H ₃ O ₂		

2. Write the balanced equation for the reaction between hydrochloric acid and sodium carbonate.
3. Write the balanced equations for the reactions between:
- Glucose and benedict's reagent
 - What color results from this reaction?
 - Ammonium chloride and benedict's reagent
 - What color results from this reaction?
4. When a strong acid is added to a base like sodium carbonate or sodium bicarbonate, fizz appears.
- What gaseous molecule causes this reaction?
 - What is this type of reaction called?
5. Identify which chemical corresponds to each of the following uses:

a.

Chemical	Use
	Lethal injection, food processing
	Deicer, heating packs
	Car-manufacture; carbon nanotubes

	Food thickener; glycogen storage disease supplement
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Glass Analysis (9 pts)

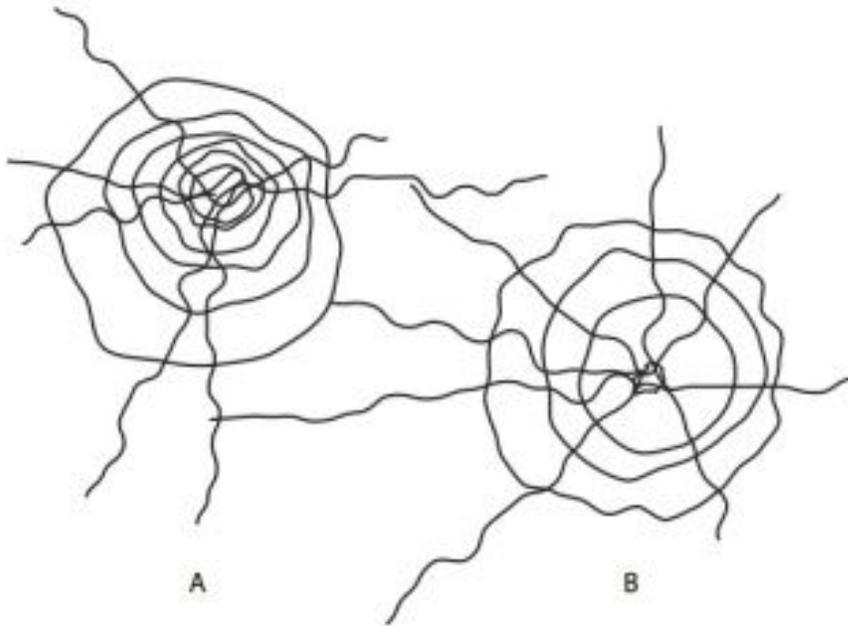
Glass Found at the Crime Scene:

A light beam is shined on the sample of glass from air (assumed to have an index of refraction of 1.000) at an angle of 45° . It is refracted through the glass at an angle of 27.7° . What is the index of refraction of the glass found at the crime scene? (Round your answer to the nearest hundredth)

What type of glass is this sample?

Name the suspect(s) implicated by the evidence:

Upon closer examination of Sandy's dome, it was noticed that there were several fractures in the glass, as shown below.



Which fracture, A or B, appeared first?

If the radial cracks are perpendicular to the side of the glass inside Sandy's dome, what does this indicate about how the rocks hit the glass?

Hair Identification (6 pts)

What animal is this hair from?

Describe the medulla of this hair.

What is the typical medullary index of this animal's hair?

Name the suspect(s) implicated by the evidence.

Hair Analysis Comprehension Questions: (5 pts)

- 1.) If a hair sample's cuticle is coronal, which of the following animals is the hair most likely from?
 - a.) cat
 - b.) bat
 - c.) horse
 - d.) dog
 - e.) none of the above
 - 2.) What is typically the root-shape of human hair?
 - 3.) Which of the following is the term for air spaces found in hair, typically near the root?
 - a.) pheomelanin
 - b.) ovoid body
 - c.) granule
 - d.) cortical fusi
 - 4.) Which of the following is the phase of hair growth known as the "resting phase"?
 - a.) telogen
 - b.) prophase
 - c.) anagen
 - d.) chemiosmosis
 - e.) metaphase
 - 5.) Which of the following is MOST LIKELY to be a feature of hair with a round cross-section?
 - a.) it's curly
 - b.) it's wavy
 - c.) it's straight
 - d.) it's in its resting phase
 - e.) it's in its growing phase
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DNA Analysis (3 pts)

Below is the DNA electrophoresis for each of the suspects along with the electrophoresis of the sample of DNA found at the crime scene.



Name the suspect(s) implicated by the evidence.

DNA Comprehension Questions: (7 pts)

- 1.) What does PCR stand for? What does it do?

- 2.) Describe the denaturation process of PCR.

- 3.) What are the four nucleotides that compose DNA?

- 4.) Which type of bonds join two nucleotides on opposite strands to form double stranded DNA?

5.) Why do smaller fragments of DNA move farther through the gel filter during electrophoresis?

Fingerprint Identification (7 pts)

Fingerprints at the crime scene:

Identify the type of fingerprint pattern of the fingerprints of each of the suspects and the fingerprint found at the crime scene:

Suspect	Fingerprints	Fingerprint Type
Spongebob		
Patrick		
Squidward		

c.) bifurcation

4.) What is a common name for cyanoacrylate fuming?

a.) What type of surface does cyanoacrylate fuming work best on?

5.) Which fingerprinting method reacts with the amino acids in the fingerprint?

Suspect Identification (22 pts)

Name the prime suspect. Note evidence that pointed to this suspect and a possible motivation:

Explain why the other suspects are not the prime suspect: